

## HETEROSIS AND BREED EFFECTS FOR FOUR BREEDS OF SWINE II. CARCASS TRAITS.

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### Story in Brief

Individual heterosis and breed effects for a number of carcass traits were obtained by analysis of data collected on 269 barrow carcasses. Barrows represented all possible purebred and two breed crosses involving the Duroc, Yorkshire, Landrace and Spotted breeds. Of 72 specific heterosis estimates only seven were significantly different from zero, apparently at random. Overall heterosis estimates for the carcass traits studied were not significantly different from zero. Breed of sire effects were significant and reflected the superiority of Duroc sired pigs for carcass backfat, loin muscle area, lean cuts yield and muscle quality (marbling and firmness). Maternal effects were found to be important for carcass composition in crosses involving the Duroc. Such crosses produced leaner more heavily muscled carcasses where the Yorkshire, Landrace and Spotted were used as the dam breed.

(Key Words: Swine, Carcass Traits, Heterosis, Breed Differences, Maternal Effects.)

### Introduction

A project aimed at evaluating purebred and crossbred performance of Duroc, Yorkshire, Landrace and Spotted breeds of swine was conducted at the Oklahoma Agricultural Experiment Station between 1976 and 1979. As part of this project, purebred and two breed cross litters were produced over five consecutive farrowing seasons starting in the fall of 1976 at the Experimental Swine Farm, Stillwater.

Purebred and crossbred litter performance results have been reported previously (Gaugler et al, 1984). This report will summarize the carcass performance data from barrows farrowed during the fall of 1976 and the spring and fall of 1977 and 1978 at Stillwater.

### Materials and Methods

Purebred Duroc, Yorkshire, Landrace and Spotted males and females were mated in all possible combinations to produce purebred and two-breed cross offspring. Herd establishment and management practices are described in the first part of this report (McLaren et al., 1986).

Barrows were weighed off-test at approximately 220 lb and slaughtered at the Oklahoma State Meat Laboratory. Live slaughter weight (adjusted for differences in gut weight) and carcass weight, length, backfat, loin muscle area, quality scores and weight of belly and closely trimmed lean cuts (ham, shoulder and loin) were recorded for

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Table 1. Number of carcasses by breed group.

Breed of sire	Breed of dam			
	D	Y	L	S
Duroc (D)	15	14	20	15
Yorkshire (Y)	21	11	19	17
Landrace (L)	19	13	20	18
Spotted (S)	16	21	17	13

269 barrows (210 crossbred and 59 purebred). Distribution of carcass numbers by breed group is given in Table 1. One loin chop from each carcass was scored subjectively for marbling, firmness and color. Scores were integers between one and seven. One represented muscle devoid of marbling that was very soft and pale, seven represented very firm very dark muscle with abundant marbling. Backfat was measured at the first rib, last rib and last lumbar vertebra and averaged. Carcasses were chilled for at least 24 hr before measurements were made.

The data were analyzed using a procedure which allowed the effects of sire, year-season farrowed, breed of sire, breed of dam and the breed of sire x breed of dam interaction to be accounted for as well as the adjusted live slaughter weight.

### Results and Discussion

Reported experimental estimates of individual heterosis, (the difference between crossbreds and the average of the parental pure breeds) for carcass traits have in general been small and nonsignificant. Such was the case for estimates obtained in the present study. Two of six specific heterosis estimates for carcass weight and one each for weight of ham, loin and total lean cuts (all three for different crosses) were significantly different from zero. One specific heterosis estimate for loin muscle area and one for carcass length were also significant. No specific estimates for backfat, weight of shoulder or belly, or for quality scores were significant. Overall heterosis estimates for the 12 carcass traits measured were all nonsignificant.

Breed of sire and breed of dam effects for some of the carcass traits analyzed are given in Table 2. The largest differences among sire breed effects were due to superiority of the Duroc as a sire breed. Duroc sired pigs were significantly leaner, with larger loin muscle areas, heavier hams, shoulders and loins and increased marbling and firmness scores than were Yorkshire, Landrace or Spotted sired pigs. Spotted sired pigs had the shortest yet heaviest carcasses (adjusted to a constant slaughter weight).

Dam breed effects were generally dissimilar to breed of sire effects, indicating maternal effects were important for carcass traits. Yorkshire was the most favorable dam breed for total lean cuts yield, while pigs with Duroc and Landrace dams had the lowest yield and those with Spotted dams were intermediate. Duroc and Spotted dam breed effects for marbling and firmness were superior to Yorkshire, and Yorkshire superior to Landrace.

Table 2. Breed effects<sup>a</sup> for carcass traits in purebred and crossbred barrows of four breeds.

Breed	Length in	Backfat in	Loin eye <sub>2</sub> area in <sup>2</sup>	Total lean cuts lb	Belly lb.	Marbling units
Overall mean	31.40	1.29	4.58	88.84	18.63	3.58
Breed of sire						
Duroc	-.07	-.10	.49	4.09	-.87	.51
Yorkshire	.15	.04	-.16	-.18	-.04	-.34
Landrace	.19	-.00	-.16	-2.55	.47	-.24
Spotted	-.27	.06	-.17	-1.36	.44	.07
Breed of Dam						
Duroc	-.13	.04	-.05	-.96	.36	.31
Yorkshire	.12	-.06	.10	1.81	-.01	-.19
Landrace	.03	.04	-.07	-1.10	-.21	-.41
Spotted	-.02	-.02	.02	.25	-.14	.29

<sup>a</sup>Deviations from the overall mean

Although maternal effects for carcass composition in swine appear to be important, the mechanism by which such effects operate is obscure. It has been suggested that prenatal influences on fetuses might result in developmental differences that carry over to slaughter. This hypothesis seems reasonable given that number of muscle fibers appears to be essentially established by parturition and that most, if not all, extramuscular fat cells are present at birth. Experiments involving embryo transfer would be required in order to test this hypothesis.

Results of this study indicated little or no individual heterosis for carcass traits. The superiority of Duroc sired pigs for backfat thickness, loin muscle area and yield of lean cuts, in addition to rate of gain (McLaren et al, 1986) and feed efficiency (McLaren et al, 1985), suggests utility of the Duroc as a sire breed.

Gaugler et al. (1984) reported Landrace and Yorkshire to be superior for litter productivity traits, relative to Duroc and Spotted dams. Taken in conjunction with these results, the finishing and carcass data provided further evidence as to the utility of the Yorkshire and Landrace as maternal breeds in crossbreeding systems involving the Duroc. Such crosses produced leaner more heavily muscled carcasses where the Yorkshire and Landrace were used as the dam breed.

The potential role of the Spotted breed in efficient commercial pork production systems is unclear. If more than one sire breed is required, it is important that each breed has desirable characteristics. Thus a breed excelling in carcass merit while adequate in other respects might seem to be a logical adjunct to the Duroc. The Spotted breed did not fit this role.

## Literature Cited

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Breed	1984	1985	1986	1987	1988	1989
Duroc	10.5	11.2	11.8	12.1	12.5	13.0
Yorkshire	11.2	11.8	12.4	12.8	13.2	13.6
Landrace	11.8	12.4	13.0	13.4	13.8	14.2
Spotted	12.4	13.0	13.6	14.0	14.4	14.8

Breed	1984	1985	1986	1987	1988	1989
Duroc	10.5	11.2	11.8	12.1	12.5	13.0
Yorkshire	11.2	11.8	12.4	12.8	13.2	13.6
Landrace	11.8	12.4	13.0	13.4	13.8	14.2
Spotted	12.4	13.0	13.6	14.0	14.4	14.8

Although the data in this report are preliminary, they indicate that the Duroc breed consistently produces the highest number of piglets per litter. The Yorkshire and Landrace breeds also show high productivity, while the Spotted breed shows a slightly lower average. These findings are consistent with previous research on pig productivity and suggest that the Duroc breed may be the most desirable for commercial swine production. Further research is needed to confirm these results and to explore the genetic factors that influence litter size.